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The coal seams of the volga-ural region (Russia): Composition, trace elements and conditions of the formation

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Abstract

© SGEM2017. All Rights Reserved. There is a growing interest in the world in coal as critical raw materials. Coal also can be a carrier of many valuable components. An important geological and geochemical task is to find out the conditions for their accumulation in the coal. The complex of trace elements including group of rare earth elements (REEs) has been studied in the coal seams of the Volga-Ural region (Russia). The article is considered the main regularities and reasons of the concentration of trace elements in coal seams. In the Volga-Ural region, economically important coal seams are encountered in the terrigenous Visean Formation (Early Carboniferous). Coal seams lie at the depth about 1 km. The thickness of a major coal seam ranges from 1 to 40 m. The coal has low ash content (around 15 - 26%) and sulfur ranging from 1.49 to 10.22%. The composition of coal ash is dominated by Si (48.9%) and Al (39.7%) oxides. Mineral substance of the coal consists essentially of kaolin, quartz, feldspar, calcite, pyrite, etc. Such minerals as gypsum, muscovite, rutile, magnetite, ilmenite, marcasite, sphalerite, galena, etc are also found in coal. The content of the most of trace elements is usually within average values for coal. High concentrations of Ge (around 20-25 ppm) and Ag (up to 8 ppm) have been discovered in a number of the coal deposits. The coal is characterized by the presence of geochemical anomalies and elevated concentrations of certain trace elements, including REEs. The Volga-Ural coal exhibits a strong enrichment of LREE over HREE (La/Yb ratio is greater than 1). A distinctive feature of the REEs distribution in the coal is anomalous Ce concentrations near the contact with host rocks. The Ce concentration in coal may reach a few tens of ppm. The nature of Ce anomalies in coal can be explained by the change of the pH conditions at a contact between the coal (acidic) and the host rocks (alkaline), by composition of surrounding rocks and the chemical properties of cerium. Under alkaline conditions, trivalent cerium, which is present in carbonate rocks, is oxidized to tetravalent form and easily dissolves in the water. Then, under acidic conditions, tetravalent cerium precipitates within organic matter as a mineral. Mineral and chemical composition of the coal in Volga-Ural region is directly dependent on the paleo-geographic conditions and depositional facies. The composition of the Visean coal is closely related to the composition of the surrounding rocks and the depositional environments during Visean time. The coal-bearing formation has been formed within the local depressions in Tournaisian carbonate deposits along the ancient sea coast in warm and wet climate. The main source of mineral matter and trace elements were weathering rocks around peatlands. Carbonate rocks surround the Visean coal-bearing formation. These rocks are characterized by low content of mafic minerals.

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Keywords

Coal, Composition, Concentration, Conditions of the formation, Trace elements

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